WHAT IS CLAIMED IS:

1. A method of producing a phase shift mask blank wherein the method includes at least a step of forming one or more phase shift film on a substrate, and in the step, the phase shift film is formed by the sputtering method by simultaneously discharging at least one or more silicon target and one or more target selected from the group consisting of a metal silicide, a metal silicide oxide, a metal silicide nitride, a metal silicide oxide nitride, a metal silicide oxide carbide, a metal silicide nitride carbide, and a metal silicide oxide nitride carbide.

2. The method of producing a phase shift mask blank according to Claim 1 wherein a composition ratio of metal and silicon in the phase shift film is changed by adjusting discharge powers applied to each target.

3. The method of producing a phase shift mask blank according to Claim 1 wherein a metal component of the target is molybdenum.

4. The method of producing a phase shift mask blank according to Claim 2 wherein a metal component of the target is molybdenum.

5. The method of producing a phase shift mask blank according to Claim 1 wherein when the phase shift film is

formed by the sputtering method, a gas containing oxygen, nitrogen, or carbon as a constituent element is used as a sputtering gas.

6. The method of producing a phase shift mask blank according to Claim 2 wherein when the phase shift film is formed by the sputtering method, a gas containing one or more elements selected from oxygen, nitrogen and carbon as constituent elements is used as a sputtering gas.

7. The method of producing a phase shift mask blank according to Claim 3 wherein when the phase shift film is formed by the sputtering method, a gas containing one or more elements selected from oxygen, nitrogen and carbon as constituent elements is used as a sputtering gas.

8. A method of producing a phase shift mask wherein a pattern is formed on the phase shift film of the phase shift mask blank produced by the production method according to any one of claims 1-7.

9. A phase shift mask blank wherein at lest one or more phase shift films are formed on a substrate, the phase shift mask films contain at least metal and silicon as constituent elements, and the phase shift films are formed by a sputtering method by simultaneously discharging at least one or more silicon target and one or more target

selected from the group consisting of a metal silicide, a metal silicide oxide, a metal silicide nitride, a metal silicide oxide nitride, a metal silicide oxide carbide, a metal silicide nitride carbide, and a metal silicide oxide nitride carbide.

10. The phase shift mask blank according to Claim 9 wherein the phase shift film comprises a metal silicide, a metal silicide oxide, a metal silicide nitride, a metal silicide oxide nitride, a metal silicide oxide carbide, a metal silicide nitride carbide, or a metal silicide oxide nitride carbide.

11. The phase shift mask blank according to Claim 9 wherein a metal component of the phase shift film is molybdenum.

12. The phase shift mask blank according to Claim 10 wherein a metal component of the phase shift film is molybdenum.

13. The phase shift mask blank according to Claim 9 wherein a center value of a distribution of phase differences in the phase shift film to wavelength of light used in exposure is 180 $\pm$10 degrees, and a center value of a distribution of transmittances in the phase shift film is 3-40%.

14. The phase shift mask blank according to Claim 10 wherein a center value of a distribution of phase differences in the phase shift film to wavelength of light used in exposure is 180 ±10 degrees, and a center value of a distribution of transmittances in the phase shift film is 3-40%.

15. The phase shift mask blank according to Claim 11 wherein a center value of a distribution of phase differences in the phase shift film to wavelength of light used in exposure is 180 ±10 degrees, and a center value of a distribution of transmittances in the phase shift film is 3-40%.

16. The phase shift mask blank according to Claim 12 wherein a center value of a distribution of phase differences in the phase shift film to wavelength of light used in exposure is 180 ±10 degrees, and a center value of a distribution of transmittances in the phase shift film is 3-40%.

17. The phase shift mask blank according to Claim 9 wherein a distribution of phase differences in the phase shift film to wavelength of light used in exposure is within ±1.5°, and a distribution of transmittances in the phase shift film is within ±0.15%.

18. The phase shift mask blank according to Claim 10 wherein a distribution of phase differences in the phase shift film to wavelength of light used in exposure is within ±1.5°, and a distribution of transmittances in the phase shift film is within ±0.15%.

19. The phase shift mask blank according to Claim 11 wherein a distribution of phase differences in the phase shift film to wavelength of light used in exposure is within ±1.5°, and a distribution of transmittances in the phase shift film is within ±0.15%.

20. The phase shift mask blank according to Claim 12 wherein a distribution of phase differences in the phase shift film to wavelength of light used in exposure is within ±1.5°, and a distribution of transmittances in the phase shift film is within ±0.15%.

21. The phase shift mask blank according to Claim 13 wherein a distribution of phase differences in the phase shift film to wavelength of light used in exposure is within ±1.5°, and a distribution of transmittances in the phase shift film is within ±0.15%.

22. The phase shift mask blank according to Claim 14 wherein a distribution of phase differences in the phase

shift film to wavelength of light used in exposure is within ±1.5°, and a distribution of transmittances in the phase shift film is within ±0.15%.

23. The phase shift mask blank according to Claim 15 wherein a distribution of phase differences in the phase shift film to wavelength of light used in exposure is within ±1.5°, and a distribution of transmittances in the phase shift film is within ±0.15%.

24. The phase shift mask blank according to Claim 16 wherein a distribution of phase differences in the phase shift film to wavelength of light used in exposure is within ±1.5°, and a distribution of transmittances in the phase shift film is within ±0.15%.

25. A phase shift mask wherein a pattern is formed on the phase shift film of the phase shift mask blank according to any one of Claims 9-24.

26. A phase shift mask blank wherein the phase shift mask blank comprises at least a multilayer phase shift film composed of two or more layers of phase shift films on a substrate, the multilayer phase shift film comprises a metal silicide compound, and a metal content in an outermost layer of the phase shift film in the multilayer phase shift film is 1/20-1/3 (molar ratio) of a metal

content of a phase shift film which contains the most metal among the phase shift films in the multilayer phase shift film.

27. The phase shift mask blank according to Claim 26 wherein the metal silicide compound comprises a metal silicide and a compound of oxygen and/or nitrogen.

28. The phase shift mask blank according to Claim 26 wherein the metal silicide compound comprises a compound of a molybdenum silicide.

29. The phase shift mask blank according to Claim 27 wherein the metal silicide compound comprises a compound of a molybdenum silicide.

30. The phase shift mask blank according to Claim 26 wherein a Cr base light shielding film and/or a Cr base antireflection film is formed on the multilayer phase shift film.

31. The phase shift mask blank according to Claim 27 wherein a Cr base light shielding film and/or a Cr base antireflection film is formed on the multilayer phase shift film.

32. The phase shift mask blank according to Claim 28

wherein a Cr base light shielding film and/or a Cr base antireflection film is formed on the multilayer phase shift film.

33. The phase shift mask blank according to Claim 29 wherein a Cr base light shielding film and/or a Cr base antireflection film is formed on the multilayer phase shift film.

34. A phase shift mask wherein a pattern is formed on the multilayer phase shift film of the phase shift mask blank according to Claims 26-33.

35. A method of producing a phase shift mask blank wherein the method includes at least a step of forming a multilayer phase shift film composed of two or more layers of films comprising a metal silicide compound on a substrate by a sputtering method, in the step, the sputtering film formation is performed with plural targets having a different composition ratio between a metal and silicon in components and with a sputtering gas containing at least oxygen and/or nitrogen, and by changing a combination of each discharge power applied to the plural targets, the multiplayer phase shift film in which a metal content in an outermost layer of the phase shift film is 1/20-1/3 (molar ratio) of a metal content in a phase shift film which contains the most metal among the phase shift films in the

multilayer phase shift film is formed.

36. The method of producing a phase shift mask blank according to Claim 35 wherein at least one or more metal silicide target and one or more silicon target are used as the plural targets.

37. The method of producing a phase shift mask blank according to Claim 35 wherein a metal component of the metal silicide target contains molybdenum.

38. The method of producing a phase shift mask blank according to Claim 36 wherein a metal component of the metal silicide target contains molybdenum.

39. The method of producing a phase shift mask blank according to Claim 35 wherein in the case of forming the multilayer phase shift film by a sputtering method with the plural targets, when any one of layers in the multilayer phase shift film is formed, targets used for forming the layer are discharged with a required discharge power to form the layer, and when the other layers in the multilayer phase shift film are formed, the discharge power is lowered to 1/20 or more of the required discharge power, so that all of targets used for forming the multilayer phase shift film are continuously discharged without shutdown of the discharge.

40. The method of producing a phase shift mask blank according to Claim 36 wherein in the case of forming the multilayer phase shift film by a sputtering method with the plural targets, when any one of layers in the multilayer phase shift film is formed, targets used for forming the layer are discharged with a required discharge power to form the layer, and when the other layers in the multilayer phase shift film are formed, the discharge power is lowered to 1/20 or more of the required discharge power, so that all of targets used for forming the multilayer phase shift film are continuously discharged without shutdown of the discharge.

41. The method of producing a phase shift mask blank according to Claim 37 wherein in the case of forming the multilayer phase shift film by a sputtering method with the plural targets, when any one of layers in the multilayer phase shift film is formed, targets used for forming the layer are discharged with a required discharge power to form the layer, and when the other layers in the multilayer phase shift film are formed, the discharge power is lowered to 1/20 or more of the required discharge power, so that all of targets used for forming the multilayer phase shift film are continuously discharged without shutdown of the discharge.

42. The method of producing a phase shift mask blank according to Claim 38 wherein in the case of forming the multilayer phase shift film by a sputtering method with the plural targets, when any one of layers in the multilayer phase shift film is formed, targets used for forming the layer are discharged with a required discharge power to form the layer, and when the other layers in the multilayer phase shift film are formed, the discharge power is lowered to 1/20 or more of the required discharge power, so that all of targets used for forming the multilayer phase shift film are continuously discharged without shutdown of the discharge.

43. A method of producing a phase shift mask wherein a pattern is formed by a lithography method on the multilayer phase shift film of the phase shift mask blank according to any one of Claims 35-42.

44. A method of producing a phase shift mask blank wherein the method includes at least a step of forming two or more layers of phase shift films, each of which has a different composition from the others, on a substrate in order by a sputtering method with two or more targets, and in the step, each layer of the phase shift films is formed by continuously discharging targets used for forming any one of the layers of the phase shift films without shutdown even when the other layers of the phase shift films are

formed.

45. The method of producing a phase shift mask blank according to Claim 44 wherein in the step of forming each layer of the phase shift films, when any one of the layers of the phase shift films is formed with targets used for forming the layer, the targets are discharged with a required discharge power to form the phase shift film, and when the other layers of the phase shift films are formed, the targets are continuously discharged while the discharge power is lowered.

46. The method of producing a phase shift mask blank according to Claim 44 wherein the phase shift films comprising a metal element, Si, N, and O as constituent elements are formed.

47. The method of producing a phase shift mask blank according to Claim 45 wherein the phase shift films comprising a metal element, Si, N, and O as constituent elements are formed.

48. The method of producing a phase shift mask blank according to Claim 46 wherein the metal element is Mo.

49. The method of producing a phase shift mask blank according to Claim 47 wherein the metal element is Mo.

50. A method of producing a phase shift mask wherein a pattern is formed by a lithography method on the phase shift films of the phase shift mask blank produced by the production method according to any one of Claims 44-49.

51. A phase shift mask blank wherein the phase shift mask blank comprises two or more layers of phase shift films having different components on a substrate, and each of the two or more layers of the phase shift films contains 1-10% of compositions of adjacent layers.

52. The phase shift mask blank according to Claim 51 wherein the phase shift films comprise a metal element, Si, N, and O as constituent elements.

53. The phase shift mask blank according to Claim 52 wherein the metal element is Mo.

54. A phase shift mask wherein a pattern is formed on the phase shift film of the phase shift mask blank according to any one of Claims 51-53.

55. A method of producing a phase shift mask blank wherein the method includes at least a step of forming one or more layers of phase shift films on a substrate by a sputtering method, and in the step, the phase shift films are formed

by the sputtering method while simultaneously discharging plural targets having different compositions.